



# CNS Modeling



Glenn Research Center

## VAST Communications, Navigation, and Surveillance Modeling

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## OBJECTIVES

- **Develop requirements for CNS modeling that supports evaluation of advanced airspace concepts**
  - Identify and categorize CNS modeling and simulation capabilities and needs
  - Identify CNS modeling approach
  
- **Develop communication, navigation and surveillance models for today's system, technologies currently being considered within the FAA's OEP, and technologies being considered for the future**
  - Develop and demonstrate standard communications traffic model for assessing CNS model elements and architectures
  - Integrate CNS modeling activities into Airspace Modeling Toolbox

## STATUS

### **Identification and categorize of existing CNS capabilities for modeling and simulation**

- Exploration for sources of model or simulation needed - Draft study in submitted and an update being prepared

### **Identify CNS modeling and simulation needs**

- Existing AATT and DAG-TM CNS requirements from the basis of this activity

### **CNS modeling approach**

- Definition being worked.

## STATUS

- **Develop and demonstrate standard communications traffic model for assessing CNS model elements and architectures**
  - FASTE-CNS development to provide communications, navigation or surveillance traffic profiles
    - Acceptance Test Conducted 12/20/02
    - Beta Testing Start 03/03
- **Integrate CNS modeling activities into Airspace Modeling Toolbox**
  - Awaiting Contractor Start

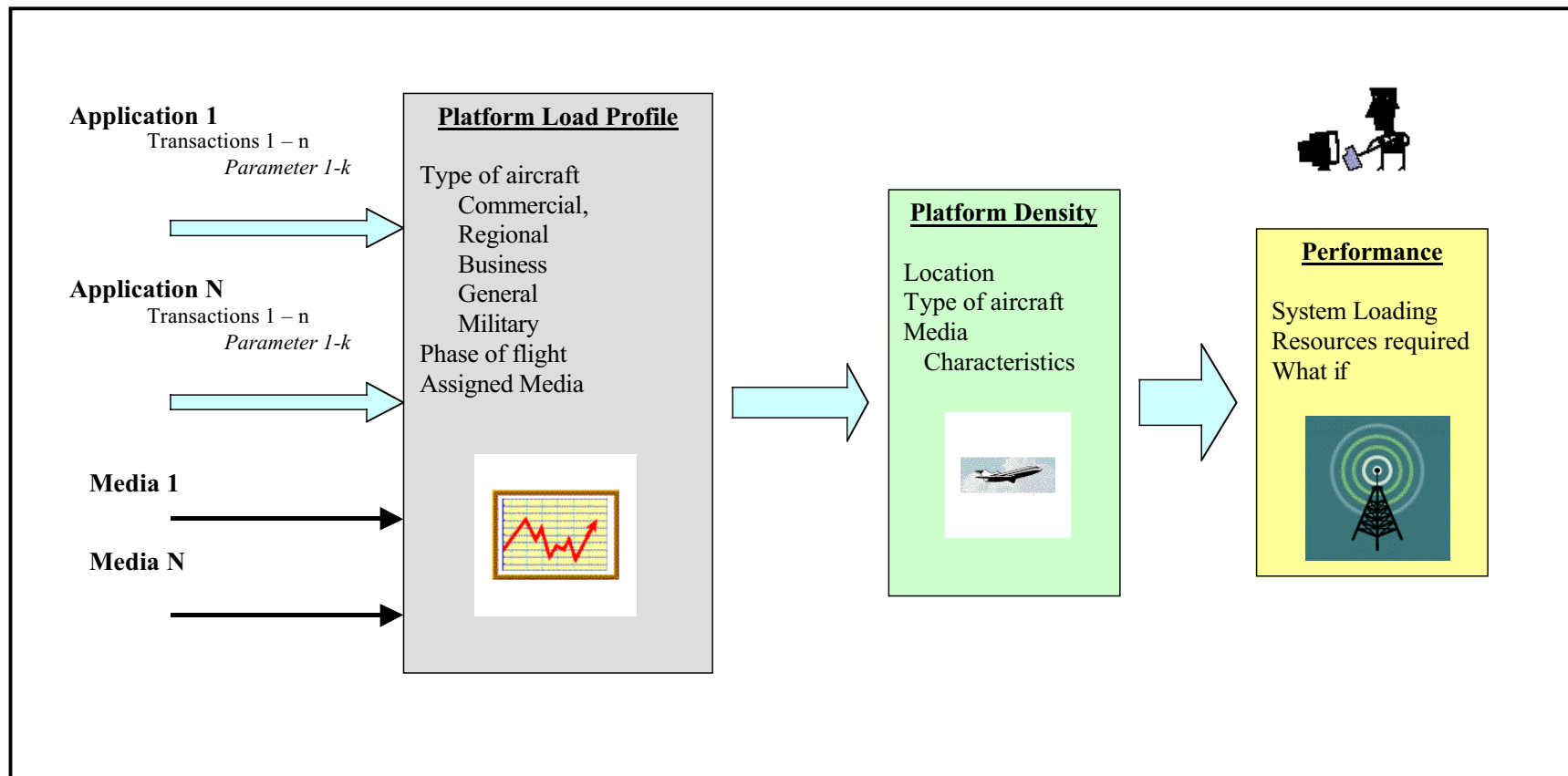
## FASTE-CNS Project Summary

- Title: Future Aeronautical Subnetwork Traffic Emulator for Communications, Navigation & Surveillance (FASTE - CNS)
- Project: Develop a dynamic communications estimating tool that is accessible via the Internet. FASTE-CNS supports collaborative research by providing a means to define and assess the communications traffic loading associated with aeronautical related applications.
- Plan/Deliverables:
  - Phase I. System Design/Software Development (Complete)
    - System Specification & System Design Drawings & Reviews
    - Software Requirements & Detailed Design Document & Review
    - Software Development, Integration & Test
  - Phase II. Hosting & Evaluation (Planned for 2nd Qtr FY03)
- Today's Status: Preparing SOW for Phase II: Beta Test Phase

## Background

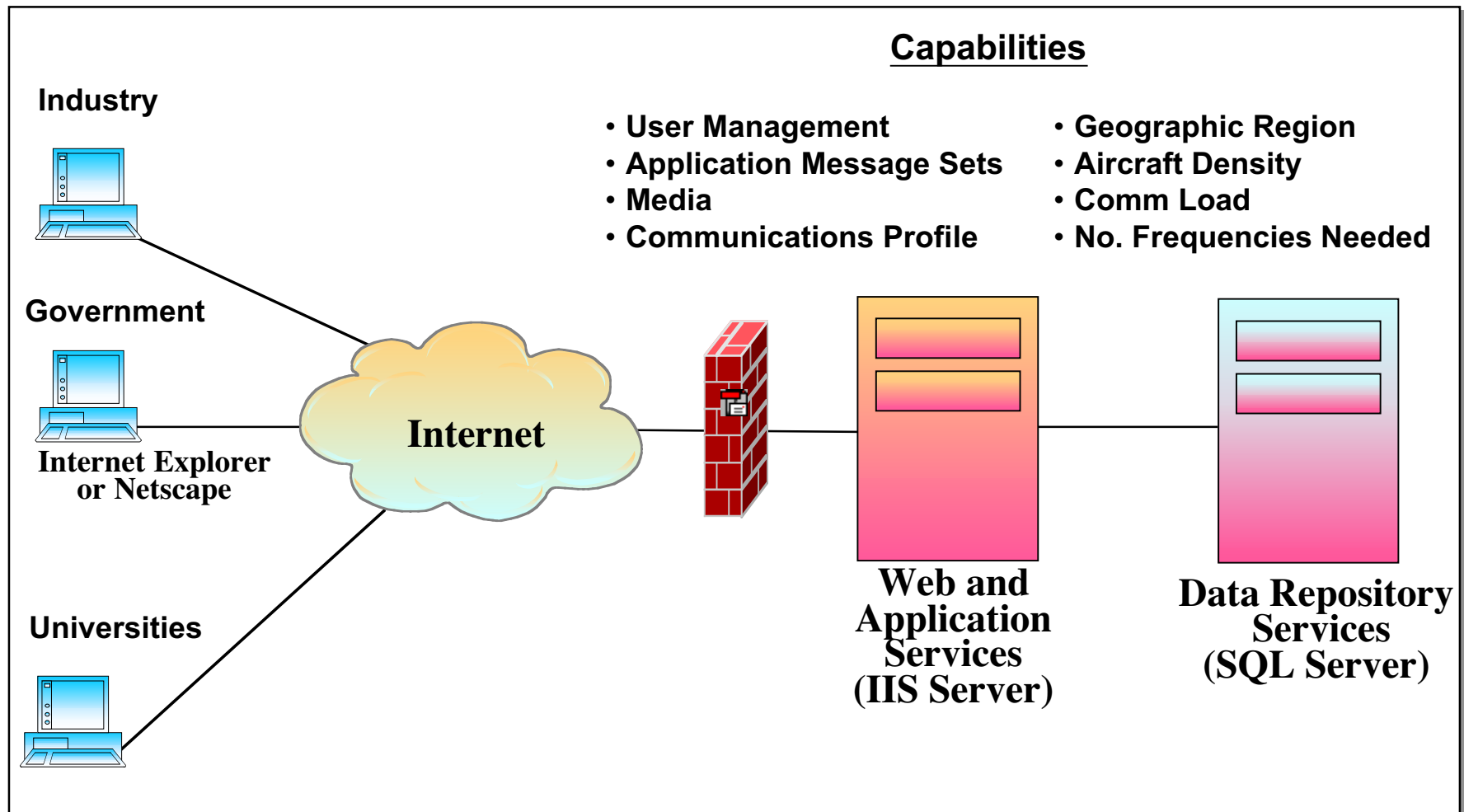
- Studies of future operational concepts and related CNS architecture definitions.
- A common, recurring study task is the communications loading analysis.
- Each study has this similar and costly activity.
- Desire granularity in loading projections but often settle for macro assessments due to cost or lack of information.
- Need to develop an industry consensus on future applications, transaction dimensions, and future aircraft population.
- Support the “what if” systems analysis and the NASA VAMS Program.

## Generic Loading Analysis



**All Driven by Operational Concepts**

## FASTE-CNS System Architecture



## Features

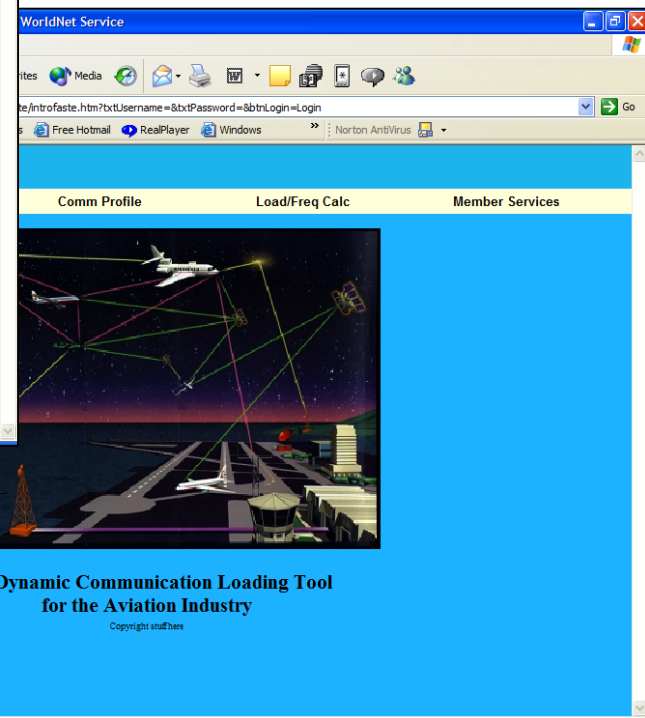
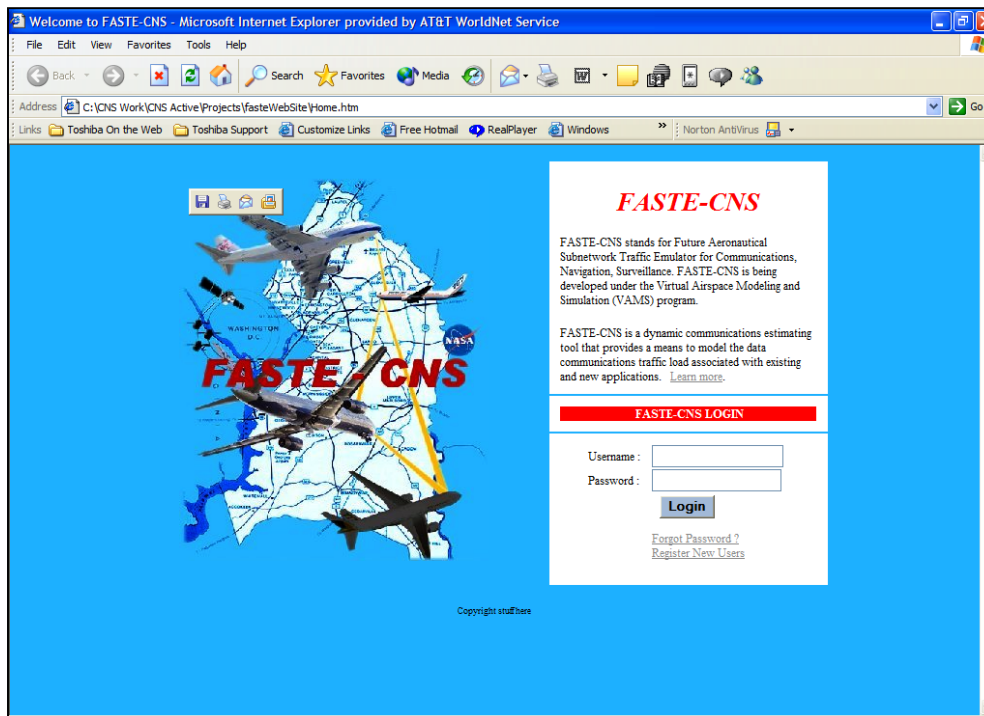
- Each application profile may be allocated to different communication subnets.
- Each researcher may keep a number of application profiles on file for later use as well as have access to sets of typical applications profiles.
- Loading displayed for a typical flight profile.
- Airspace model depicts number of aircraft within selected airspace.
- Aggregate assessment of throughput requirements calculated to allow assessment of resources for various subnetworks.
- High-level performance models for the communications subnetworks available.
- Means to collaborate between researches provided.

## Internet-Based

FASTE-CNS is an Internet-based aeronautical communications calculation capability that will support geographically dispersed NASA, FAA, university, and contractor communications evaluations for the future aeronautical environment of the 48 contiguous states in the Continental United States (CONUS).

- Authorized users access the system using common web browsers such as Internet Explorer and Netscape.
- User Accounts
  - FASTE-CNS provides a mechanism to establish user accounts.
  - Account holders can establish their own user identification (ID) and password.

## Home Page



## User Inputs are Flexible

- Application Message Sets
  - A user can define the communicated messages associated with an application.
  - Select and use an application from a library of public applications, or save it as a private application for his/her use.
  - Print desired application message sets.
- Communications Traffic Profiles
  - A user can define a communications traffic profile, which is a series of applications and their associated media.
  - Select and use a profile from a library of public profiles, or can save it as a private profile for his/her use.
  - Print desired profiles.

## Message Set Definition

Opening Message Set - Microsoft Internet Explorer provided by AT&T WorldNet Service

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media

Address C:\CNS Work\CNS Active\Projects\FasteWebSite\AMSOpen.htm Go

Links Toshiba On the Web Toshiba Support Customize Links Free Hotmail RealPlayer Windows Norton AntiVirus

**FASTE - CNS**

Message Set Media Comm Profile Load/Freq Calc Member Services

### Open / Edit Message Set

Creator : Sanil Vidyanandan  
E-mail : Sanil.Vidyanandan@cns.w.com

Flight Time: 1 Hour 40 Minutes, Take Off: 15 Minutes , En Route: 60 Minutes , Landing: 25 Minutes

Message Set: CPDLC 1

Description:  
CPDLC Traffic s1m1ulation using SARP version x.y.z. Similarly sized messages have been aggregated together as a single entry. This is the testing of AMS messages. This is another sample AMS. Testing

Message	Size (Kbits)	Flight Phase	Freq	Freq Unit	Mode	Type	Comments	Delete
UM19	1	Take Off	1	In Phase	Human	Receive	Climb Faste Testing. Fast	<input type="checkbox"/>
DM0	3	Take Off	4	In Phase	Human	Transmit	Wilco	<input type="checkbox"/>
UM19	1	Take Off	1	In Phase	Human	Receive	Climb	<input type="checkbox"/>
DM0	3	Take Off	4	In Phase	Human	Transmit	Wilco	<input type="checkbox"/>
UM98	1	EnRoute	1	Per Minute	Human	Receive	Tum	<input type="checkbox"/>
DM1	1	EnRoute	1	In Phase	Human	Transmit	Unable	<input type="checkbox"/>
DM2	1	EnRoute	1	At Minute	Human	Transmit	Stand By	<input type="checkbox"/>
UM200	1	EnRoute	1	Per Minute	Human	Receive	No speed limit	<input type="checkbox"/>
DM0	2	EnRoute	2	Per Minute	Human	Transmit	Wilco	<input type="checkbox"/>

## Communications Forecast Data Model

- A communications forecast data model combines a user-selected group of communications traffic profiles and an aircraft density profile to describe the total communications traffic of interest in a geographical region.
- A user can assign separate communications traffic profiles to subsets of the total number of aircraft within a sub-region.
- The communications traffic loads for each type of media within a region (and its sub-regions) can be printed to provide researchers with an understanding of the data link communications requirements within the region.

## Creating a Comm Profile

Creating New Message Set - Microsoft Internet Explorer provided by AT&T WorldNet Service

File Edit View Favorites Tools Help

Address: C:\CNS Work\CNS Active\Projects\fasteWebSite\Media\Open2.htm

Links: Toshiba On the Web, Toshiba Support, Customize Links, Free Hotmail, RealPlayer, Windows, Norton AntiVirus

**FASTE - CNS**

Message Set Media Comm Profile Load/Freq Calc Member Services

**Open / Edit Media**

Creator: Chris Wargo

Email: Chris.Wargo@hotmail.com

Media: VDL2 (Private)

**Media - VDL2**

Description: VDL2(testrun)

Range (Miles): 200

Capacity (kbps)/Frequency: 5.5

Print Save Save As

Open/Edit Comm Profile - Microsoft Internet Explorer provided by AT&T WorldNet Service

File Edit View Favorites Tools Help

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Links: Toshiba On the Web, Toshiba Support, Customize Links, Free Hotmail, RealPlayer, Windows, Norton AntiVirus

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Message Set Media Comm Profile Load/Freq Calc Member Services

**Open / Edit Comm Profile**

Creator: Chris Wargo

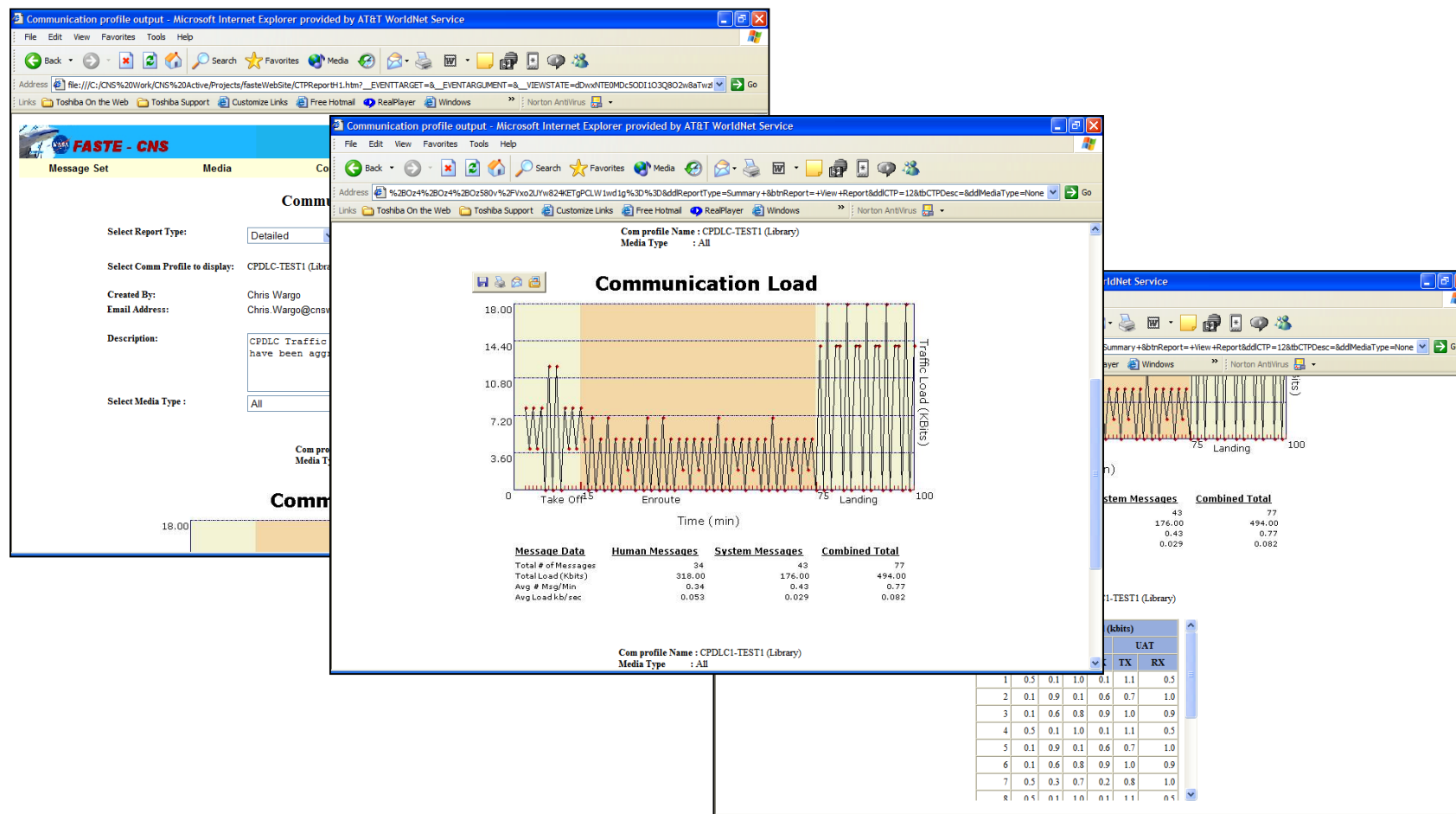
E-mail: Chris.Wargo@cns.w.com

Comm Profile: CPDLC-TEST1 (Private)

Description:

Message Set	Media	Delete
CPDLC1 (Library)	VDL2 (Private)	<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>

## Communications Load Display

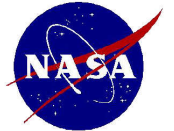


## Researchers Can Collaborate

- Aircraft Density Profiles (Fleet Placement)
  - A user can define a geographic region composed of contiguous sub-regions and assign a number of aircraft to each sub-region to define an aircraft density profile. The largest profile supported covers the entire CONUS.
- Load & Frequency Calculation Model
  - A user can associate a comm profile with each group of aircraft to define a load & frequency calculation model.
  - Select and use a model from a library of public models, or save a new model as a private model for his/her use.
  - Print desired models.



# CNS Modeling

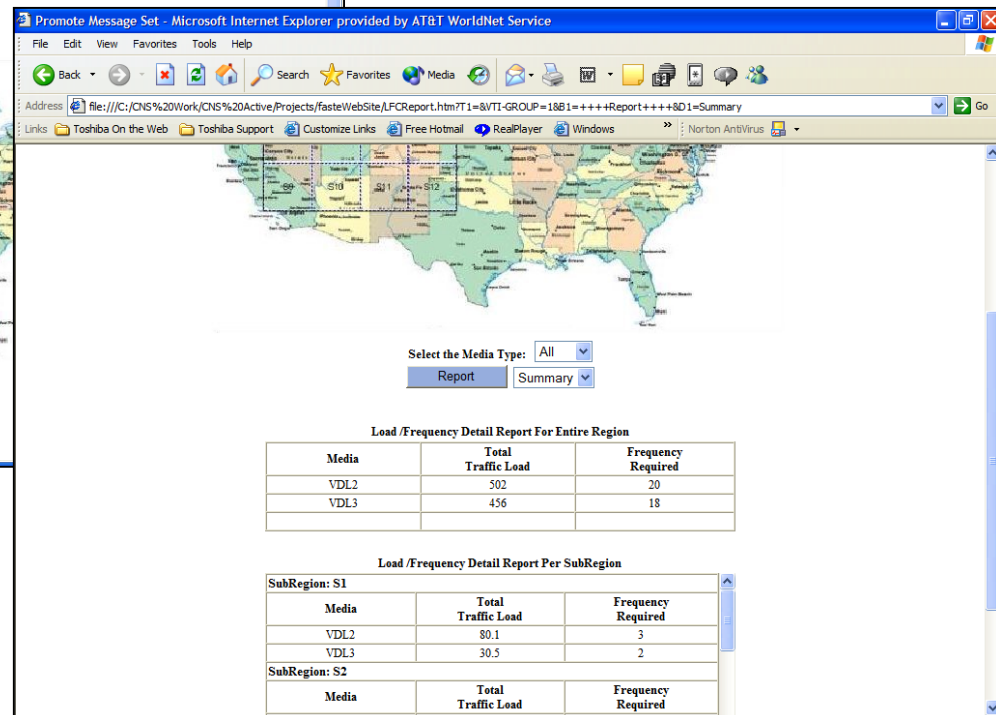
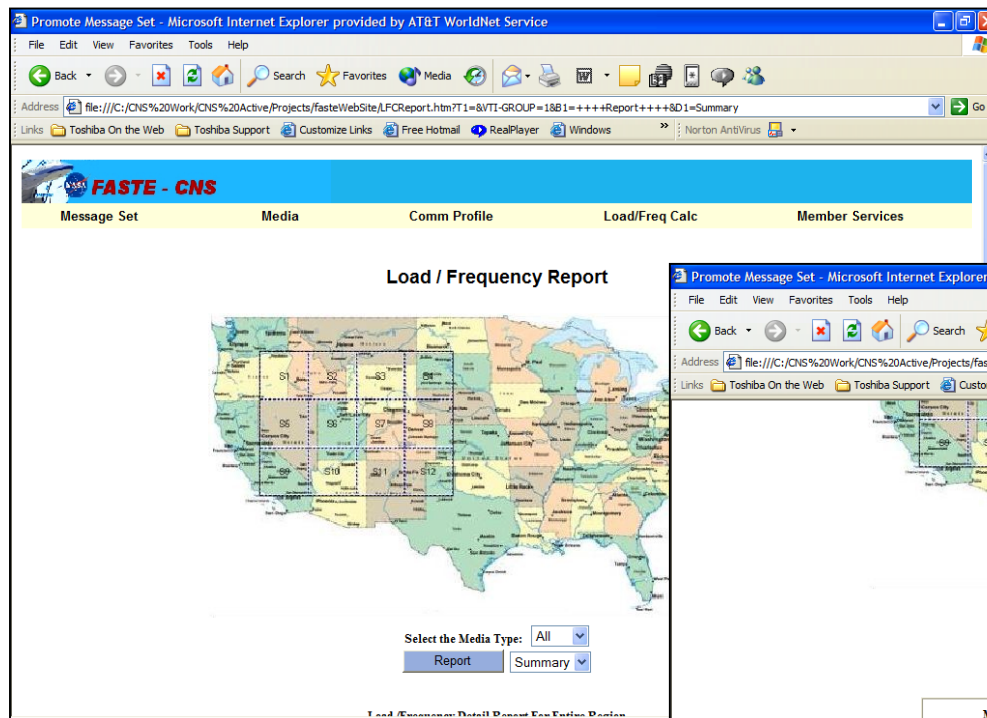


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## Performance Modeling

- System Loading and Frequency Requirements
- FASTE-CNS calculates the loading requirements needed to support the geographical region defined in the density profile.
- FASTE-CNS calculates the frequency requirements needed to support the geographical region defined in the density profile.
- Results can be displayed in textual format.

## Load/Frequency Report



## Phase II Potential Functions

- Enhance Media Performance Models
- Use as a configuration tool to set-up and define the tests that other CNS models would perform
- Export configuration data using HLA/RTI to the Virtual Airspace Modeling and Simulation (VAMS) System
- Import route models and apply communications traffic loading results from the route concept models
- Develop as web access mechanism to the NASA Virtual Airspace Modeling and Simulation Toolkit.



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## Next Project Steps

- Seek participants for BETA test
- Increase functionally and fidelity of subnetwork models



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## Demonstration

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443-994-6137